CLAIMS

1. A data communication system comprising a home agent, a correspondent node capable of communicating with the home agent, a mobile router, and
5   a mobile network node capable of communicating with the mobile router, the mobile router comprising:
a plurality of communication means of a communication service containing same or different types of services;
a control table which stores an address assigned to the communication
10 means and route information of the communication means, such that the address and the route information are associated with each other; and
a transferring means which receives a packet from the mobile network node addressed to the correspondent node, selects usable communication means based on information of the control table, and transfers the packet to the
15 home agent,
the home agent comprising:
means for identifying the address assigned to the usable communication means of the mobile router;
a control table which stores the identified address and route information of
20 the address, such that the address and the route information are associated with each other; and
transferring means which receives a packet from the correspondent node addressed to the mobile network node, selects an address based on information of the control table, and transfers the packet to the address,
25 wherein a logical line, through which the mobile network node and the correspondent node communicate with each other, is configured by combining lines of the plurality of communication means.

2. A data communication system comprising a home agent and a mobile
30 router,
the mobile router comprising:
a plurality of communication means of a communication service containing same or different types of services;
a control table which stores an address assigned to the communication
35 means and route information of the communication means, such that the address and the route information are associated with each other; and

transferring means which receives a packet, selects usable communication means based on the control table, and transfers the packet to the home agent,

the home agent comprising:

5 means for identifying an address assigned to usable communication means of the mobile router;

a control table which stores the identified address and route information of the address, such that the address and the route information are associated with each other; and

10 transferring means which receives a packet, selects an address based on information of the control table, and transfers the packet to the address, wherein a logical line, through which the mobile network node and the correspondent node communicate with each other, is configured by combining lines of the plurality of communication means.

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3. A data communication system comprising a home agent, a correspondent node capable of communicating with the home agent, a mobile router, and a mobile network node capable of communicating with the mobile router, the mobile router comprising:

20 a plurality of communication means which communicate with the home agent;

a control table which stores route information containing an address assigned to the plurality of communication means; and

means for receiving a packet from the mobile network node addressed to

25 the correspondent node, selecting at least one of the communication means based on information of the control table, and transferring the packet to the home agent,

the home agent comprising:

means for identifying an address assigned to usable communication means

30 of the mobile router;

a control table which stores route information containing the identified address; and

means for receiving a packet from the correspondent node addressed to the mobile network node, selecting at least one address based on information

35 of the control table, and transferring the packet to the address,

wherein a logically multiplexed line, through which the mobile network and the correspondent node communicate with each other, is configured by combining the plurality of communication means between the mobile router and the home agent.

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4. The data communication system according to any one of claims 1 to 3, wherein the mobile router comprises: means for detecting a change in connection status of the communication means currently-in-use; and means for notifying the home agent of the change in connection status and an

10   address assigned to the communication means, and the home agent comprises means for updating, based on the notification, information in the control table that manages an address of the communication means of the mobile router.

15   5. The data communication system according to any one of claims 1 to 4, wherein

the mobile router comprises means for notifying the home agent of an address of the communication means scheduled to be disconnected before disconnecting a currently-connected line of the communication means, and

20   the home agent comprises means for deleting, based on the notification, information related to the address of the communication means which the home agent is notified of, from the control table.

6. The data communication system according to any one of claims 1 to 5,

25   wherein

the mobile router comprises means for notifying the home agent of an address of the communication means predicted to be disconnected when an event occurs where disconnection of a currently-connected line of the communication means is predictable, and the home agent comprises means

30   for updating, based on the notification, information in the control table that manages the address of the mobile router.

7. The data communication system according to any one of claims 1 to 6, wherein

35   the mobile router comprises means for responding to a packet from the home agent, and the home agent comprises means for regularly

transmitting a packet to a plurality of addresses that the mobile router has and means updating information in the control table that manages an address of the mobile router by determining the address as unusable if response is not made from the address to the packet.

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8. The data communication system according to any one of claims 1 to 7, wherein

the home agent comprises: means for estimating an address of usable communication means of the mobile router based on positional information of the mobile router,; and the updating means for updating information in the control table that manages an address of the mobile router based on the estimation.

9. The data communication system according to any one of claims 1 to 8, wherein the route information in the control table of the mobile router includes at least one from a group of communication means or a kind of line, a packet delay, a bandwidth of the line, and usage information.

10. The data communication system according to any one of claims 1 to 9, wherein the route information in the control table of the home agent includes at least one from a group of communication means or a kind of line, a packet delay, a bandwidth of the line, and a timing enabling transmission of the next packet.

11. The data communication system according to any one of claims 1 to 10, wherein the transferring means of the home agent is means for selecting an address to which transmission is possible by calculating a transmission timing based on the route information in the control table, so as not to generate a packet loss.

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12. The data communication system according to any one of claims 1 to 11, wherein the home agent selects a transmission timing and a destination address using means which is different depending on a QoS class of a received packet.

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13. The data communication system according to any one of claims 1 to 12, wherein the mobile router selects communication means using means which is different depending on a QoS class of a received packet.

5   14. The data communication system according to any one of claims 1 to 13, wherein the mobile router comprises: means for monitoring a traffic amount of the mobile network node thereunder and means for connecting and disconnecting a channel to the outside based on the traffic amount.

10   15. The data communication system according to any one of claims 1 to 14, wherein the mobile router comprises:
a control table which manages policy information mapped to respective communication means; and
transferring means, when transferring a packet to the home agent, which
15   selects the communication means based on the policy information and transfers the packet,
and the home agent comprises:
a control table which manages policy information mapped to respective addresses of the mobile router; and
20   transferring means, when transferring a packet to the mobile router, which selects an address of the mobile router based on the policy information and transfers the packet,
wherein utilization of a plurality of communication means is determined between the home agent and the mobile router, based on the policy
25   information.

16. The data communication system according to claim 15, wherein the policy information is information on a communication fee of individual communication means.

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17. The data communication system according to claim 15 or 16, wherein utilization of individual communication means is determined based on the policy information, such that a total of the communication fees is minimized.

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18. The data communication system according to any one of claims 15 to 17, wherein
when it is assumed that:
the communication means adopts a measured-rate billing system;
5　the data communication system comprises "N" units of communication means, that is, a first to a Nth communication means;
information on the communication fee is given such that:
the first communication means has a communication unit price of a1, and a bandwidth of B1;
10　the second communication means has a communication unit price of a2 (>a1), and a bandwidth of B2;
as repeated in the same manner hereafter,
the Nth communication means has a communication unit price of aN (>a(N-1)) and a bandwidth of BN, and
15　a bandwidth required for current communication is C;
the data communication system:
finds the largest M which satisfies the inequality: $C >= B1+B2+...+BM$, when the bandwidths of the communication means are sequentially added starting from that of the first communication means;
20　uses all the bandwidths of the first to the Mth communication means; and uses C-B1-B2- ... -BM from of the bandwidth of the $(M+1)^{th}$ communication means, thereby using a line such that a total of the communication fees is minimized.

25　19. The data communication system according to any one of claims 16 to 18, which uses communication means adopting a flat-rate billing system in preference to communication means adopting a measured-rate billing system.

30　20. The data communication system according to any one of claims 16 to 19, wherein
when it is assumed that:
the first to M^{th} communication means adopts a flat-rate billing system;
the Mth to N^{th} communication means adopts a measured-rate billing system;
35　the data communication system comprises "N" units of communication means, that is, the first to the Nth communication means;

a total bandwidth of the first to M^{th} communication means is B0,
the information on the communication fee is given such that:
the $(M+1)^{th}$ communication means has a communication unit price of
a(M+1), and a bandwidth of B(M+1); and the $(M+2)^{th}$ communication

5　means has a communication unit price of a(M+2) (>a(M+1)), and a
bandwidth of B(M+2);
as repeated in the same manner hereafter,
the Nth communication means has a communication unit price of aN
(>a(N-1)) and a bandwidth of BN, and

10　a bandwidth required for current communication is C,
the data communication system:
if C<=B0, uses one of the first to M^{th} communication means, and
if C>B0, finds the largest L which satisfies the inequality: C >=
B0+B1+B2+...+BL, when the bandwidths of the communication means are

15　sequentially added starting from that of the first communication means;
uses all the bandwidths of the first to the Lth communication means; and
uses C-B1-B2- ... -BL of the bandwidth of the $(L+1)^{th}$ communication
means, thereby using a line such that a total of the communication fees is
minimized.

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21. The data communication system according to any one of claims 16 to
20, wherein a communication fee is changed in accordance with a date and
time, and utilization of individual communication means is changed in
accordance with this change.

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22. The data communication system according to any one of claims 16 to
21, wherein the mobile router and the home agent change the policy
information based on positional information of the mobile router.

30　23. The data communication system according to any one of claims 16 to
21, wherein a communication fee is changed in accordance with a place,
and utilization of individual communication means is changed in
accordance with this change.

35　24. The data communication system according to any one of claims 15 to
23, wherein the home agent comprises means for distributing the policy

information including the policy information in the response message when receiving notification of an address from the mobile router.

25. The data communication system according to any one of claims 1 to 24, wherein the mobile router comprises sequence control means which controls a sequence of received packets.

26. The data communication system according to any one of claims 1 to 25, characterized in that the home agent comprises sequence control means which controls a sequence of received packets.

27. A mobile router in a data communication system comprising a home agent, a correspondent node capable of communicating with the home agent, a mobile router, ; and a mobile network node capable of communicating with the mobile router, the mobile router comprising:
a plurality of communication means of a communication service containing same or different types of services;
a control table which stores an address assigned to the communication means and route information of the communication means, such that the address and the route information are associated with each other; and
transferring means which receives a packet from the mobile network node addressed to the correspondent node, selects usable communication means based on information of the control table, and transfers the packet to the home agent,
wherein a logical line, through which a packet addressed to the correspondent node from the mobile network node is transferred to the home agent, is configured by combining lines of the plurality of communication means.

28. A mobile router in a data communication system comprising a home agent and a mobile router,
the mobile router comprising:
a plurality of communication means of a communication service containing same or different types of services;

a control table which stores an address assigned to the communication
means and route information of the communication means, such that the
address and the route information are associated with each other; and
transferring means which receives a packet, selects usable communication
5   means based on the control table, and transfers the packet to the home
agent,
wherein a logical line, through which the mobile router and the home agent
communicate to each other, is configured by combining lines of the
plurality of communication means.

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29. A mobile router in a data communication system comprising a home
agent, a correspondent node capable of communicating with the home
agent, a mobile router, and a mobile network node capable of
communicating with the mobile router, the mobile router comprising:
15   a plurality of communication means which communicate with the home
agent;
a control table which stores route information containing an address
assigned to the plurality of communication means; and
transferring means which receives a packet from the mobile network node
20   addressed to the correspondent node, selects at least one of the
communication means based on information of the control table, and
transfers the packet to the home agent,
wherein a logically multiplexed line, through which a packet addressed to
the correspondent node from the mobile network node is transferred to the
25   home agent, is configured by combining lines of the plurality of
communication means.

30. The mobile router according to any one of claims 27 to 29, further
comprising:
30   means for detecting a change in connection status of the communication
means currently-in-use; and
means for notifying the home agent of the change in connection status and
an address assigned to the communication means.

35   31. The mobile router according to any one of claims 27 to 30, further
comprising:

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means for notifying the home agent of an address of the communication
means scheduled to be disconnected, before disconnecting a
currently-connected line of the communication means.

5   32. The mobile router according to any one of claims 27 to 31, further
     comprising;
     means for notifying the home agent of an address of the communication
     means predicted to be disconnected, when an event occurs where
     disconnection of a currently-connected line of the communication means is
10   predictable.

     33. The mobile router according to any one of claims 27 to 32, further
     comprising:
     means for responding to a packet from the home agent for investigating a
15   usable address.

     34. The mobile router according to any one of claims 27 to 33, wherein the
     route information in the control table of the mobile router includes at least
     one from a group of communication means or a kind of line, a packet delay,
20   a bandwidth of the line, and usage information.

     35. The mobile router according to any one of claims 27 to 34, wherein the
     mobile router selects communication means using means which is different
     depending on a QoS class of a received packet.
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     36. The mobile router according to any one of claims 27 to 35, further
     comprising:
     means for monitoring a traffic amount of a mobile network node
     thereunder; and
30   means for connecting and disconnecting a channel to the outside based on
     the traffic amount.

     37. The mobile router according to any one of claims 27 to 36,
     the mobile router comprises:
35   a control table which manages policy information mapped to respective
     communication means; and

transferring means, when transferring a packet to the home agent, which selects the communication means based on the policy information and transfers the packet,

wherein utilization of a plurality of communication means is determined
5   based on the policy information.

38. The mobile router according to claim 37, wherein the policy information is information on a communication fee of individual communication means.

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39. The mobile router according to claim 37 or 38, wherein the transferring means determines utilization of individual communication means based on the policy information, such that a total of the communication fees is minimized.

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40. The mobile router according to any one of claims 37 to 39, wherein when it is assumed that:

the communication means adopts a measured-rate billing system;

the data communication system comprises "N" units of communication
20   means, that is, a first to a Nth communication means;

information on the communication fee is given such that:

the first communication means has a communication unit price of a1, and a bandwidth of B1;

the second communication means has a communication unit price of a2
25   (>a1), and a bandwidth of B2;

as repeated in the same manner hereafter,

the Nth communication means has a communication unit price of aN (>a(N-1)) and a bandwidth of BN, and

a bandwidth required for current communication is C,
30   the mobile router:

finds the largest M which satisfies the inequality: $C >= B1+B2+...+BM$, when the bandwidths of the communication means are sequentially added starting from that of the first communication means;

uses all the bandwidths of the first to the Mth communication means; and
35   uses C-B1-B2- ... -BM of the bandwidth of the $(M+1)^{th}$ communication means, thereby

using a line such that a total of the communication fees is minimized.

41. The mobile router according to any one of claims 38 to 40, which uses communication means adopting a flat-rate billing system in preference to
5 communication means adopting a measured-rate billing system.

42. The mobile router according to any one of claims 37 to 41, wherein when it is assumed that:
the first to M^{th} communication means adopts a flat-rate billing system;
10 the Mth to N^{th} communication means adopts a measured-rate billing system;
the data communication system comprises "N" units of communication means, that is, the first to the Nth communication means;
a total bandwidth of the first to M^{th} communication means is B0,
15 the information on the communication fee is given such that:
the $(M+1)^{th}$ communication means has a communication unit price of a(M+1), and a bandwidth of B(M+1); and the $(M+2)^{th}$ communication means has a communication unit price of a(M+2) (>a(M+1)), and a bandwidth of B(M+2);
20 as repeated in the same manner hereafter,
the Nth communication means has a communication unit price of aN (>a(N-1)) and a bandwidth of BN, and
a bandwidth required for current communication is C,
the mobile router:
25 if C<=B0, uses one of the first to Mth communication means, and
if C>B0, finds the largest L which satisfies the inequality: C >= B0+B1+B2+...+BL, when the bandwidths of the communication means are sequentially added starting from that of the first communication means;
uses all the bandwidths of the first to the Lth communication means; and
30 uses C-B1-B2- ... -BL of the bandwidth of the $(L+1)^{th}$ communication means, thereby
using a line such that a total of the communication fees is minimized.

43. The mobile router according to any one of claims 37 to 42, wherein a
35 communication fee is changed in accordance with a date and time, and

utilization of individual communication means is changed in accordance with this change.

44. The mobile router according to any one of claims 37 to 43, wherein the
5　mobile router changes the policy information based on positional information of the mobile router.

45. The mobile router according to any one of claims 37 to 44, wherein a communication fee is changed in accordance with a place, and utilization
10　of individual communication means is changed in accordance with this change.

46. The mobile router according to any one of claims 27 to 45, characterized in that the mobile router comprises sequence control means
15　which controls a sequence of received packets.

47. A home agent in a data communication system comprising a home agent, a correspondent node capable of communicating with the home agent, a mobile router, and a mobile network node capable of
20　communicating with the mobile router, the home agent comprising:
means for identifying an address assigned to usable communication means among communication means of a communication service containing same or different types of services of the mobile router;
a control table which stores the identified address and route information of
25　the address, such that the address and the route information are associated with each other; and
transferring means which receives a packet addressed to the mobile network node from the correspondent node, selects the address based on the control table, and transfers the packet to the address,
30　wherein a logical line, through which a packet addressed to the mobile network node is transferred to the mobile router, is configured by combining lines of the plurality of communication means.

48. A home agent in a data communication system comprising a home
35　agent and a mobile router,
the home agent comprises:

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means for identifying an address assigned to usable communication means among communication means of a communication service containing same or different types of services of the mobile router;

a control table which stores the identified address and route information of
5   the adders, such that the address and the route information are associated with each other; and

means which receives a packet, selects an address based on information of the control table, and transfers the packet to the address,

wherein a logical line, through which the home agent communicates with
10   the mobile router, is configured by combining lines of the plurality of communication means.

49. A home agent in a data communication system comprising a home agent, a correspondent node capable of communicating with the home
15   agent, a mobile router, and a mobile network node capable of communicating with the mobile router, the home agent comprising:

means for identifying an address assigned to usable communication means of the mobile router;

a control table which stores route information containing the identified
20   address; and

means for receiving a packet addressed to the mobile network node from the correspondent node, selecting at least one of the addresses of the mobile router based on information of the control table, and transferring the packet to the address,

25   wherein a logically multiplexed line, through which the home agent communicates with the mobile router, is configured by combining lines of the plurality of communication means.

50. The home agent according to any one of claims 47 to 49, further
30   comprising:

means for updating the information of the control table that manages an address of the communication means of the mobile router, based on a change in connection status with the mobile router and notification of the address assigned to the communication means.

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51. The home agent according to any one of claims 47 to 50, further comprising:

means for deleting from the control table, information related to an address of the communication means which the home agent is notified of, based on notification of an address of the communication means scheduled to be disconnected from the mobile connector.

52. The home agent according to any one of claims 47 to 51, further comprising:

means for updating information in the control table that manages an address of the mobile router, based on notification of an address of the communication means predicted to be disconnected from the mobile router.

53. The home agent according to any one of claims 47 to 52, further comprising:

means for regularly transmitting a packet to a plurality of addresses the mobile router has; and

means for determining an address as unusable if no response is made to the packet from the address, and updating information in the control table that manages an address of the mobile router.

54. The home agent according to any one of claims 47 to 53, further comprising:

means for estimating an address of usable communication means of the mobile router based on positional information of the mobile router; and means for updating information in the control table that manages an address of the mobile router, based on the estimation.

55. The home agent according to any one of claims 47 to 54, wherein the route information in the control table of the home agent includes at least one from a group of communication means or a kind of line, a packet delay, a bandwidth of the line, and a timing enabling transmission of the next packet.

56. The home agent according to any one of claims 47 to 55, wherein the transferring means of the home agent is means for selecting an address to

which transmission is possible by calculating a transmission timing based on the route information in the control table, so as not to generate a packet loss.

5　57. The home agent according to any one of claims 47 to 56, wherein the home agent selects a transmission timing and a destination address using means which is different depending on a QoS class of a received packet.

58. The home agent according to any one of claims 47 to 57,
10　wherein the home agent comprises:
a acontrol table which manages policy information mapped to respective addresses of the mobile router; and
transferring means, when transferring a packet to the mobile router, which selects an address of the mobile router based on the policy information and
15　transfers the packet,
wherein utilization of a plurality of communication means is determined based on the policy information between the home agent and the mobile router.

20　59. The home agent according to claim 58, wherein the policy information is information on a communication fee of individual communication means.

60. The home agent according to claim 58 or 59, wherein the transferring
25　means determines utilization of individual communication means based on the policy information, such that a total of the communication fees is minimized.

61. The home agent according to any one of claims 58 to 60, wherein
30　when it is assumed that:
the communication means adopts a measured-rate billing system;
the data communication system comprises "N" units of communication means, that is, a first to a Nth communication means;
information on the communication fee is given such that:
35　the first communication means has a communication unit price of a1, and a bandwidth of B1;

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the second communication means has a communication unit price of a2
(>a1), and a bandwidth of B2;
as repeated in the same manner hereafter,
the Nth communication means has a communication unit price of aN
5　(>a(N-1)) and a bandwidth of BN, and
a bandwidth required for current communication is C,
the home agent:
finds the largest M which satisfies the inequality: C >= B1+B2+...+BM,
when the bandwidths of the communication means are sequentially added
10　starting from that of the first communication means;
uses all the bandwidths of the first to the Mth communication means; and
uses C-B1-B2- ... -BM of the bandwidth of the $(M+1)^{th}$ communication
means, thereby
using a line such that a total of the communication fees is minimized.

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62. The home agent according to any one of claims 58 to 61, wherein the
home agent uses communication means adopting a flat-rate billing system
in preference to communication means adopting a measured-rate billing
system.

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63. The home agent according to any one of claims 58 to 62, wherein
when it is assumed that:
the first to M^{th} communication means adopts a flat-rate billing system;
the Mth to N^{th} communication means adopts a measured-rate billing system;
25　the data communication system comprises "N" units of communication
means, that is, the first to the Nth communication means;
a total bandwidth of the first to M^{th} communication means is B0,
the information on the communication fee is given such that:
the $(M+1)^{th}$ communication means has a communication unit price of
30　a(M+1) and a bandwidth of B(M+1); and the (M+2)th communication
means has a communication unit price of a(M+2) (>a(M+1)) and a
bandwidth of B(M+2);
as repeated in the same manner hereafter,
the Nth communication means has a communication unit price of aN
35　(>a(N-1)) and a bandwidth of BN, and
a bandwidth required for current communication is C,

the data communication system:
if C<=B0, uses one of the first to M^{th} communication means, and
if C>B0, finds the largest L which satisfies the inequality: C >=
B0+B1+B2+...+BL, when the bandwidths of the communication means are
5   sequentially added starting from that of the first communication means;
uses all the bandwidths of the first to the Lth communication means; and
uses C-B1-B2- ... -BL of the bandwidth of the $(L+1)^{th}$ communication
means, thereby using a line such that a total of the communication fees is
minimized.

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64. The home agent according to any one of claims 58 to 63, wherein a
communication fee is changed in accordance with a date and time, and
utilization of individual communication means is changed in accordance
with this change.

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65. The home agent according to any one of claims 58 to 64, wherein the
home agent changes the policy information based on positional information
of the mobile router.

20   66. The home agent according to any one of claims 58 to 65, wherein a
communication fee is changed in accordance with a place, and utilization
of individual communication means is changed in accordance with this
change.

25   67. The home agent according to any one of claims 58 to 66, further
comprising means for distributing the policy information including the
policy information in the response message when receiving notification of
an address from the mobile router.

30   68. The home agent according to any one of claims 47 to 67, further
comprising sequence control means which controls a sequence of a
received packets.

69. A program of a mobile router in a data communication system
35   comprising a home agent, a correspondent node capable of communicating

with the home agent, a mobile router; and a mobile network node capable
of communicating with the mobile router,
the program causing the mobile router
to function as a plurality of communication means of a communication
5　 service containing a same or different types of services;
to function as transferring means which receives a packet from the mobile
network node to the correspondent node, selects usable communication
means based on information of the control table which stores an address
assigned to the communication means and route information of the
10　 communication means, such that the address and the route information are
associated with each other, and transfers the packet to the home agent,
wherein a logical line, through which a packet addressed to the
correspondent node from the mobile network node is transferred to the
home agent, is configured by combining lines of the plurality of
15　 communication means.

70. A program of a mobile router in a data communication system
comprising a home agent and a mobile router,
the program causing the mobile router
20　 to function as a plurality of communication means of a communication
service containing a same or different types of services;
to function as transferring means which receives a packet, selects usable
communication means based on the control table which stores an address
assigned to the communication means and route information of the
25　 communication means, such that the address and the route information are
associated with each other, and transfers the packet to the home agent,
wherein a logical line, through which the mobile router and the home agent
communicate to each other, is configured by combining lines of the
plurality of communication means.
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71. A program of a mobile router in a data communication system
comprising a home agent, a correspondent node capable of communicating
with the home agent, a mobile router, and a mobile network node capable
of communicating with the mobile router,
35　 the program causing the mobile router

to function as a plurality of communication means to communicate with the home agent;

to function as a control table which stores route information assigned to the plurality of communication means; and

5　　to function as means which receives a packet from the mobile network node addressed to the correspondent node, selects at least one of the communication means based on the control table, and transfers the packet to the home agent,

wherein a logically multiplexed line, through which a packet addressed to
10　　the correspondent node from the mobile network node is transferred to the home agent, is configured by combining lines of the plurality of communication means.

72. The program of the mobile router according to any one of claims 69 to
15　　71, wherein the program causes the mobile router

to function as means for detecting a change in connection status of the communication means currently-in-use; and

to function as means for notifying the home agent of the change in connection status and an address assigned to the communication means.
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73. The program of the mobile router according to any one of claims 69 to 72, wherein the program causes the mobile router to function as means for notifying the home agent of an address of the communication means scheduled to be disconnected, before disconnecting a currently-connected
25　　line of the communication means.

74. The program of the mobile router according to any one of claims 69 to 73, wherein the program causes the mobile router to function as means for notifying the home agent of an address of the communication means
30　　predicted to be disconnected, when an event occurs where disconnection of a currently-connected line of the communication means is predictable.

75. The program of the mobile router according to any one of claims 69 to 73, wherein the program causes the mobile router to function as means for
35　　responding to a packet from the home agent for investigating a usable address.

76. The program of the mobile router according to any one of claims 69 to 75, wherein the program causes so that the route information in the control table of the mobile router includes at least one from a group of

5　communication means or a kind of line, a packet delay, a bandwidth of the line, and usage information.

77. The program of the mobile router according to any one of claims 69 to 76, wherein the program causes to selects communication means using

10　means which is different depending on a QoS class of a received packet.

78. The program of the mobile router according to any one of claims 69 to 77, wherein the program causes the mobile router
to function as means for monitoring a traffic amount of a mobile network

15　node thereunder; and
to function as means for connecting and disconnecting a channel to the outside based on the traffic amount.

79. The program of the mobile router according to any one of claims 69 to

20　77,
wherein the program causes the mobile router to function as transferring means, when transferring a packet to the home agent, which selects the communication means based on the policy information mapped to respective communication means,

25　wherein utilization of a plurality of communication means is determined based on the policy information.

80. The program of the mobile router according to claim 79, wherein the program causes so that the policy information is information on a

30　communication fee of individual communication means.

81. The program of the mobile router according to claim 79 or 80, wherein the program causes so that the transferring means determines utilization of individual communication means based on the policy information, such

35　that a total of the communication fees is minimized.

82. The program of the mobile router according to any one of claims 79 to 81, wherein

when it is assumed that:

the communication means adopts a measured-rate billing system;

5   the data communication system comprises "N" units of communication means, that is, a first to a Nth communication means;

information on the communication fee is given such that:

the first communication means has a communication unit price of a1, and a bandwidth of B1;

10   the second communication means has a communication unit price of a2 (>a1), and a bandwidth of B2;

as repeated in the same manner hereafter,

the Nth communication means has a communication unit price of aN (>a(N-1)) and a bandwidth of BN, and

15   a bandwidth required for current communication is C,

the program:

finds the largest M which satisfies the inequality: C >= B1+B2+...+BM, when the bandwidths of the communication means are sequentially added starting from that of the first communication means;

20   uses all the bandwidths of the first to the Mth communication means; and uses C-B1-B2- ... -BM of the bandwidth of the $(M+1)^{th}$ communication means, thereby

using a line such that a total of the communication fees is minimized.

25   83. The program of the mobile router according to any one of claims 79 to 82, wherein the program causes to use communication means adopting a flat-rate billing system in preference to communication means adopting a measured-rate billing system.

30   84. The program of the mobile router according to any one of claims 79 to 82, wherein

when it is assumed that:

the first to M^{th} communication means adopts a flat-rate billing system;

the Mth to N^{th} communication means adopts a measured-rate billing system;

35   the data communication system comprises "N" units of communication means, that is, the first to the Nth communication means;

a total bandwidth of the first to M^{th} communication means is B0,
the information on the communication fee is given such that:
the $(M+1)^{th}$ communication means has a communication unit price of
a(M+1), and a bandwidth of B(M+1); and the $(M+2)^{th}$ communication

5　means has a communication unit price of a(M+2) (>a(M+1)), and a
bandwidth of B(M+2);
as repeated in the same manner hereafter,
the Nth communication means has a communication unit price of aN
(>a(N-1)) and a bandwidth of BN, and

10　a bandwidth required for current communication is C,
the program:
if C<=B0, uses one of the first to M^{th} communication means, and
if C>B0, finds the largest L which satisfies the inequality: C >=
B0+B1+B2+...+BL, when the bandwidths of the communication means are

15　sequentially added starting from that of the first communication means;
uses all the bandwidths of the first to the Lth communication means; and
uses C-B1-B2- ... -BL of the bandwidth of the $(L+1)^{th}$ communication
means, thereby
using a line such that a total of the communication fees is minimized.

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85. The program of the mobile router according to any one of claims 79 to
84, wherein the program causes so that the communication fee is changed
in accordance with a date and time, and utilization of individual
communication means is changed in accordance with this change.

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86. The program of the mobile router according to any one of claims 79 to
85, wherein the program causes to change the policy information based on
positional information of the mobile router.

30　87. The program of the mobile router according to any one of claims 79 to
86, wherein the program causes so that the communication fee is changed
in accordance with a place, and utilization of individual communication
means is changed in accordance with this change.

88. The program of the mobile router according to any one of claims 70 to 87, wherein the program causes the mobile router to function as sequence control means which controls a sequence of a received packets.

5   89. A program of a home agent in a data communication system comprising a home agent, a correspondent node capable of communicating with the home agent, a mobile router, and a mobile network node capable of communicating with the mobile router,
the program causing the home agent
10   to function as means for identifying an address assigned to the communication means which is usable among the communication means of a communication service containing a same or different types of services; and
to function as transferring means which receives a packet from the
15   correspondent node to the mobile network node, selects an address based on information of the control table which stores the identified address and route information of the address, such that the address and the route information are associated with each other, and transfers the packet to the address,
20   thereby configuring a logical line by combining lines of the plurality of communication means, and transferring a packet from the correspondent node addressed to the mobile network node through this line to the mobile router.

25   90. A program of a home agent in a data communication system comprising a home agent and a mobile router,
the program causing the home agent
to function as means for identifying an address assigned to the communication means which is usable among the communication means of
30   a communication service containing same or different types of services; and
to function as transferring means which receives a packet, selects an address based on information of the control table which stores the identified address and route information of the address, such that the
35   address and the route information are associated with each other, and transfers the packet to the address, .

thereby configuring a logical line by combining lines of the plurality of communication means, and communicating with the mobile router through this line.

5   91. A program of a home agent in a data communication system comprising a home agent, a correspondent node capable of communicating with the home agent, a mobile router, and a mobile network node capable of communicating with the mobile router,
the program causing the home agent

10   to function as means for identifying an address assigned to the usable communication means of the mobile router;
to function as a control table which stores route information containing the identified address; and
to function as means which receives a packet from the correspondent node

15   to the mobile network node, selects at least one of the addresses of the mobile router based on the control table, and transfers the packet to the address,
thereby communicating with the mobile router through a logically multiplexed line configured by combining lines of the plurality of

20   communication means.

92. The program of a home agent according to any one of claims 89 to 91, characterized in that the program causes the home agent to function as updating information in the control table that manages an address of the

25   communication means of the mobile router, based on notification of a change in connection status and an address assigned to the communication means.

93. The program of a home agent according to any one of claims 89 to 92,

30   wherein the program causes the home agent to function as means for deleting from the control table, information related to the address of the communication means which the home agent is notified of, based on the notification of an address scheduled to be disconnected from the mobile router.

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94. The program of a home agent according to any one of claims 89 to 93, wherein the program causes the home agent to function as means for updating information in the control table that manages an address of the mobile router, based on notification of an address of the communication
5　means predicted to be disconnected from the mobile router.

95. The program of a home agent according to any one of claims 89 to 94, wherein the program causes the home agent
to function as means for regularly transmitting a packet to a plurality of
10　addresses the mobile router has; and
to function as means for determining an address as unusable if response is not made to the packet from the address, and updating information in the control table that manages an address of the mobile router.

15　96. The program of a home agent according to any one of claims 89 to 95, wherein the program causes the home agent
to function as means for estimating, based on positional information of the mobile router, an address of usable communication means of the mobile
·　router; and
20　to function as means for updating, based on the estimation, information in the control table that manages an address of the mobile router.

97. The program of a home agent according to any one of claims 89 to 96, wherein the program causes so that the route information in the control
25　table of the home agent includes at least one from a group of communication means or line, a packet delay, a bandwidth of the line, and a timing enabling transmission of the next packet.

98. The program of a home agent according to any one of claims 89 to 97,
30　wherein the program causes so that the transferring means of the home agent is means for selecting an address to which transmission is possible by calculating a transmission timing based on the route information in the control table, so as not to generate a packet loss.

35　99. The program of a home agent according to any one of claims 89 to 98, wherein the program causes to selects a transmission timing and a

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destination address using means which is different depending on a QoS class of a received packet.

100. The program of a home agent according to any one of claims 89 to 98,
5   wherein the program causes the home agent
to function as transferring means, when transferring a packet to the mobile router, which selects the address of the mobile router based on the policy information mapped to respective addresses of the mobile router, and transfers the packet, and
10   to determines utilization of a plurality of communication means with the mobile router based on the policy information.

101. The program of a home agent according to claim 100, wherein the program causes so that the policy information is information on a
15   communication fee of individual communication means.

102. The program of a home agent according to claim 100 or 101, wherein the program causes so that the transferring means determines utilization of individual communication means based on the policy information, such
20   that a total of the communication fees is minimized.

103. The program of a home agent according to any one of claims 100 to 102, wherein
when it is assumed that:
25   the communication means adopts a measured-rate billing system;
the data communication system comprises "N" units of communication means, that is, a first to a Nth communication means;
information on the communication fee is given such that:
the first communication means has a communication unit price of a1, and a
30   bandwidth of B1;
the second communication means has a communication unit price of a2 (>a1), and a bandwidth of B2;
as repeated in the same manner hereafter,
the Nth communication means has a communication unit price of aN
35   (>a(N-1)) and a bandwidth of BN, and
a bandwidth required for current communication is C,

the program:

finds the largest M which satisfies the inequality: $C >= B1+B2+...+BM$, when the bandwidths of the communication means are sequentially added starting from that of the first communication means;

5   uses all the bandwidths of the first to the Mth communication means; and uses $C-B1-B2-...-BM$ of the bandwidth of the $(M+1)^{th}$ communication means, thereby

using a line such that a total of the communication fees is minimized.

10   104. The program of a home agent according to any one of claims 100 to 103, wherein the program causes to uses communication means adopting a flat-rate billing system in preference to communication means adopting a measured-rate billing system.

15   105. The program of a home agent according to any one of claims 100 to 104, wherein

when it is assumed that:

the first to M^{th} communication means adopts a flat-rate billing system;

the Mth to N^{th} communication means adopts a measured-rate billing

20   system;

the data communication system comprises "N" units of communication means, that is, the first to the Nth communication means;

a total bandwidth of the first to M^{th} communication means is B0,

the information on the communication fee is given such that:

25   the (M+1)th communication means has a communication unit price of $a(M+1)$, and a bandwidth of $B(M+1)$; and the $(M+2)^{th}$ communication means has a communication unit price of $a(M+2)$ $(>a(M+1))$, and a bandwidth of $B(M+2)$;

as repeated in the same manner hereafter,

30   the Nth communication means has a communication unit price of aN $(>a(N-1))$ and a bandwidth of BN, and

a bandwidth required for current communication is C,

the data communication system:

if $C<=B0$, uses one of the first to M^{th} communication means, and

if C>B0, finds the largest L which satisfies the inequality: C >=
B0+B1+B2+...+BL, when the bandwidths of the communication means are
sequentially added starting from that of the first communication means;
uses all the bandwidths of the first to the Lth communication means; and

5   uses C-B1-B2- ... -BL of the bandwidth of the $(L+1)^{th}$ communication
means, thereby
using a line such that a total of the communication fees is minimized.

106. The program of a home agent according to any one of claims 100 to
10   105, wherein the program causes so that a communication fee is changed in
accordance with a date and time, and utilization of individual
communication means is changed in accordance with this change.

107. The program of a home agent according to any one of claims 100 to
15   106, wherein the program causes to changes the policy information based
on positional information of the mobile router.

108. The program of a home agent according to any one of claims 100 to
107, wherein the program causes so that a communication fee is changed in
20   accordance with a place, and utilization of individual communication
means is changed in accordance with this change.

109. The program of a home agent according to any one of claims 100 to
107, wherein the program causes the home agent to function as distributing
25   means for including the policy information in the response message when
receiving notification of an address from the mobile router, and distributing
the policy information to the mobile router.

110. The program of a home agent according to any one of claims 89 to
30   109, wherein the program causes the home agent to have sequence control
means which controls a sequence of a received packets.